A New Prescription: Pollution Prevention Strategies for the Health Care Industry

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Boston University Corporate Education Center
Tyngsborough, Massachusetts

Proceedings

Section 2: General Medical Facilities
Total Quality Management
Government Initiatives

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A Case Study: Mercury Reduction Efforts in a Clinical Laboratory

One of the oldest major Metropolitan Boston teaching Hospitals was having difficulty achieving the MWRA's mercury enforcement limit of 1 ppb in the effluent discharged from its Clinical Laboratory. Initially, extensive analysis of reagents was completed to help identify possible sources of mercury that had previously been unrecognized as entering the facility infrastructure. Training of laboratory personnel in the use of product substitutes (mercury free reagents) or the use of alternative mercury management techniques and the isolation of selective workstations from the facility infrastructure was completed but failed to correct the problem. Subsequent infrastructure investigations revealed the presence of contaminated piping which, once removed, helped the facility to achieve compliance with the enforcement standard. Details of the work performed, chemistries analyzed, timelines encountered and serial progress in reducing the mercury concentration of the effluent from parts per million to sub-parts per billion with be highlighted.

The Setting

- Major Teaching Hospital
- Merging Resources
- Escalated MWRA Enforcement
- Clinical Laboratory

blood gas and blood chemistry; chemistry; cytogenetics; hematology; immunology (including serology); microbiology (virology, mycology, bacteriology & parasitology); phlebotomy; radiology; urinalysis

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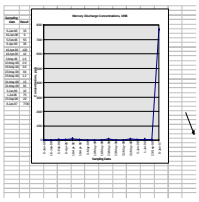

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The Problem

Effluent Mercury Discharge Concentration Peaks in January, 1997 at 7,700 ppb in 700 gpd Flow

⇒ Translates to 0.75 ounces

Was It Due to:

- A Broken Thermometer?
- A Mistaken Discharge of an Identified Mercury Bearing Reagent?
- A Legitimate Discharge of an, as yet, Unidentified Mercury Tainted Reagent?
- Something Else?

The Options

- Total Bulk Out
  - ⇒ Not feasible
  - ⇒ Not cost effective
  - ⇒ Not environmentally responsible
- End-of-Pipe
  - ⇒ Not proven
  - ⇒ Not cheap
  - ⇒ Not simple
  - ⇒ Not quick
- Localized Bulk Out*

Selected as a means of isolating the “unknown” source

The Impediments

- Multiple Level, Compound Structure
- Questionable Accuracy of “Record Drawings” due to Facility Age
- Inaccessible Piping
- Limited Floor Space
- Facility Age
- Limited Product Information
- Limited Staff Resources

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The Strategy

- Assemble the Team
  - ⇒ Facility Personnel
  - ⇒ Clinicians
  - ⇒ Administration
  - ⇒ External Support

The Process

- Verify “Special Waste” Risers
- Isolate & Redirect Non “Special Waste” Sources
- Reroute Sources to “Clean” Risers
- Replace “Accessible” Piping
- Install Collection Pails & Tanks
- Implement the Use of “Dump Logs”
- Cease All Discharge for 5 days (24 hpd)
- Collect & Analyze All Pail Contents
- Powerwash the Collection System
- Install Riser Isolation Valves
- Replace the IWWT System Tank
- Haul All Collected Wastewater

The Results

- 180 Samples Taken
  - ⇒ 22 Contained Detectable Mercury
  - ⇒ 12 Contained Mercury > 0.5 ppb
  - ⇒ 6 Contained Mercury > 1.0 ppb
- Of the Positive Hits, No Clear Trend
- “Normal” Operations Significantly and Adversely Affected
- Compliance Not Attained

Riser Wash Samples Provide a Clue

- Riser - 0.5 ppb
- Riser - 3.9 ppb < suggests an undiscovered source
- Riser - 0.6 ppb

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The Decision

- Re-Trace all “Special Waste” Lines
- Replace all “Inaccessible” Piping

The Discovery

- Foot Length of Ductile Iron (DI) & Polypropylene (PP) Piping Found Embedded Within a Wall
- Sections Extracted & Analyzed
  - ⇒ Polypropylene Pipe
    Test Sample: 1,295,000 ppb
    Leachate: 4,773 ppb
  - ⇒ Ductile Iron Pipe
    Test Sample (loose deposits): 196,000 ppb
    Scrapings from Inner Surface: 1,187,000 ppb
    Leachate: 47.5 ppb

The Solution

- Abandon Pipe, in place
- Repipe with PP

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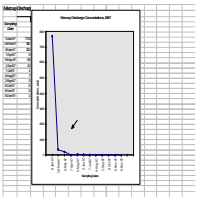

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The Cost - $75,000

Including:

- Waste Disposal
- Tank Replacement
- Powerwashing
- Accessible Pipe Replacement
- Inaccessible Pipe Replacement
- Outside Support

Excluding:

- Staff Labor
- Sample Analyses

Some Lessons Learned

- Gram & Wright Stains
- Bouins & B-5 Fixatives
- Hand Soaps & Creams
- Unadulterated Urine & Blood Products
- Boraxo® Pads

Processes & Reagents Found to Contain Mercury

Autoanalyzers:		*Reagents:*	
Autodelfia	3.1 ppb	Trichrome Blue Stain	7.1 ppb
Iris	0.3 ppb	TB Decolorizer	65.6 ppb
Cotter	0.3 ppb	Formalin	25.8 ppb
Technicon H2	0.4 ppb	Bouins	46.6 ppb
Hitachi	0.3 ppb	B-5 Fixative	148.4 ppb
Chem-Array	0.4 ppb	Effect II	23.3 ppb
Chem-IMX-1	0.4 ppb	Aldex	99.9 ppb
Chem-IMX-2	0.4 ppb	RDO	24.6 ppb
Chem-654	0.4 ppb	Sponge Exudate	124.6 ppb
Chem-Autodelfia	0.8 ppb	Chem-SEC 6	0.9 ppb
HEME MDA	2.1 ppb		

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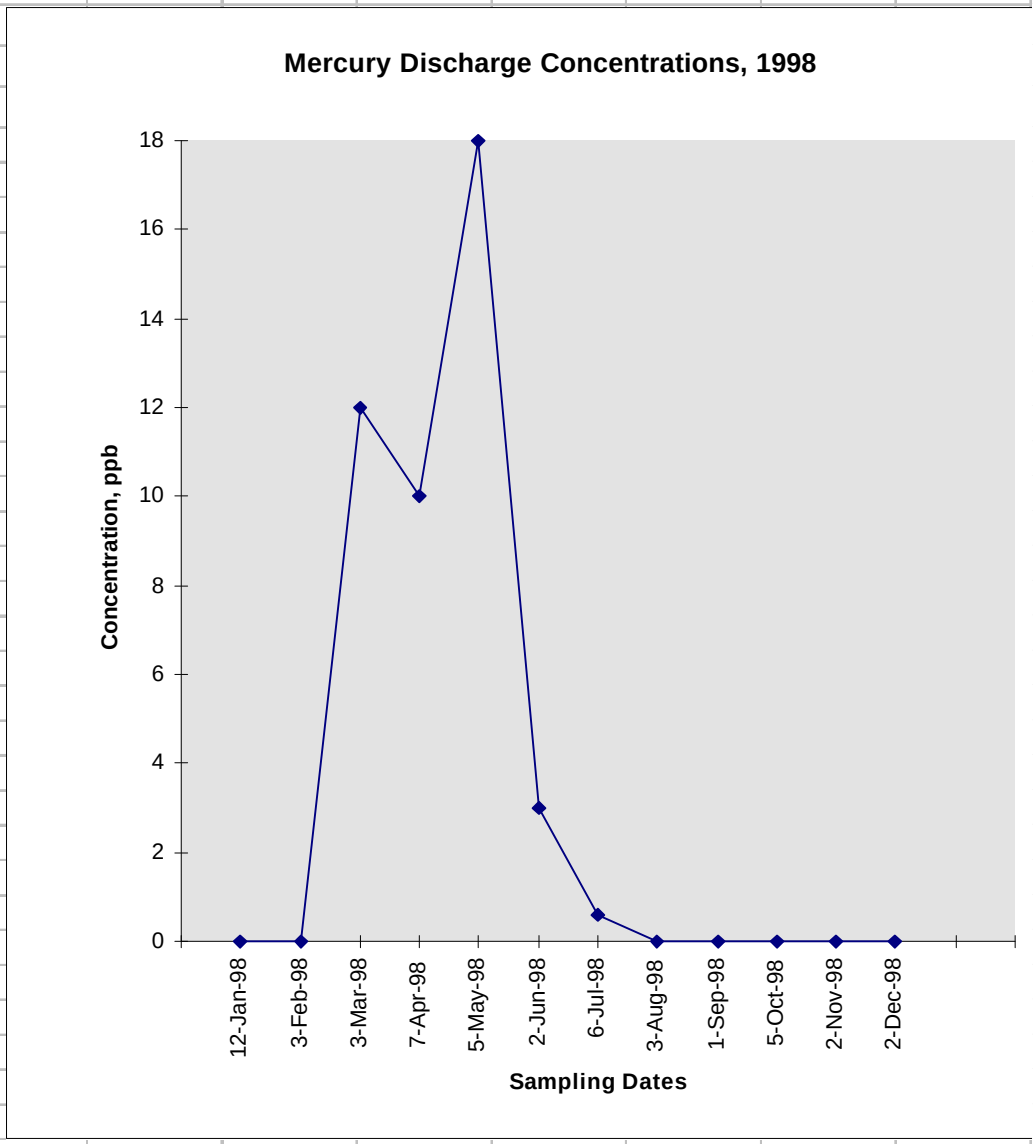
The End?

Beth Israel Deacon	
Mercury Discharge	
Sampling Date	
12-Jan-98	0
3-Feb-98	0
3-Mar-98	12
7-Apr-98	10
5-May-98	18
2-Jun-98	3
6-Jul-98	0.6
3-Aug-98	0
1-Sep-98	0
5-Oct-98	0
2-Nov-98	0
2-Dec-98	0



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Robert Gingras *is a Senior Program Director at Earth Tech currently assigned to the Environmental Compliance and Engineering Group. During his more than 20 years in the practice of professional environmental engineering, he has designed and implemented pollution prevention/waste minimization and recycling systems for a variety of clients including those in the electronics, metal finishing, textile, health care, commercial laundering and printing industries. He can be contacted at Earth Tech, 196 Baker Avenue, Concord, Massachusetts 01742-2167. Phone: (978) 341-4000.*

Scott A. George
Recycling Coordinator
Cape Cod Healthcare Inc.

Getting Started - It Takes Little Time and Makes a BIG Difference !

1) Starting from Top to Bottom :
   CEO - PRESIDENTS - NURSE MANAGERS - DIRECTORS
   MATERIALS MANAGEMENT, ENVIRONMENTAL SERVICES -
   STAFF EDUCATION - ALL DEPARTMENT HEADS ;

   all of the above must be on board and ready to accept change in how waste is handled at your facility. Drafting a memo asking for their support and commitment is essential.

2) Contents of your Recycling Memo :
   A) State your purpose and your needs.
   B) Tell of mandatory recycling and landfill cappings State wide.
   C) Lay out your strategy as to how recycling will effect your facility.

3) Form a Recycling Committee : Be sure to invite all levels of your staff to be on this committee. Meet once a month.

4) Goals and Strategies :
   A) Identify any ongoing programs.
   B) Document expenses and savings from those programs.
   C) Purchase a Recycling Bulletin Board
   D) Send out a newsletter to the general population explaining ongoing programs and ask for the staffs help.
   E) Identify obstacles and solve them.
   F) Draft a memo to be included with information packets that are handed out to new employees
   G) Create policy for ongoing and future recycling programs.
   H) At mandatory Staff meetings address recycling issues and ask the Staff for their participation.
   I) Create new recycling programs that are well thought out and cover all angles.

I have enclosed examples of memos that I have used at my Health Care Facility.
If you have any Questions feel free to contact me at:
Office: 1-508-771-1800 X 2472
Fax : 1-508-790-4657

Scott A. George
Recycling Coordinator
Cape Cod Healthcare Inc.

RECYCLING COMMITTEE PROGRESS REPORT

To: Operational Improvement Committee
From: Scott A. George; Recycling Coordinator
Re: Recycling Fiscal Impact - June , 1996 -

In February of 1995 the Recycling Committee was formed at the request of concerned employees via the Q.I. Committee. Since that time we have met monthly and continue to meet monthly. We have identified several recycling opportunities and several obstacles to those opportunities. In our meetings it is our goal to remove the obstacles and implement recycling programs whenever it is reasonable and possible.

The following is a list of recycling programs and their financial impact:

PROGRAM/PROJECT	ANNUAL SAVINGS/INCOME	STATUS
1) Mixed Paper	$4,716.00	Active
2) Cardboard	$14,184.00	Active
3) Sorting and Separating	$114,511.00	Active
4) Egg Crate Overlays	$40,000.00	Active
5) Xylene Reclaiming	$4,582.00	30 day Trial
6) Plastics	N/A	Researching
7) Mercury	N/A	Researching
8) Glass	N/A	Researching
9) Kitchen Waste	N/A	Researching
10) Batteries	N/A	Researching
11) Lighting	N/A	Researching
12) Hospital Equipment	N/A	Developing

TOTAL PROJECTED YEARLY SAVINGS..... $177,993.00

Scott A. George
Recycling Coordinator
Cape Cod Healthcare Inc.

********** A Look Into The Future **********

In the future we can see Recycling playing a huge part in our waste management at CAPE COD HEALTHCARE, Inc. To find signs of what is to come we need only look as far as our own landfills. The Commonwealth of Massachusetts mandates that most of Cape Cods landfills be capped. Presently we as residents need to separate our household trash before we bring it to our local landfills and in the future we might be asked to pay for all non-separated and non-recyclable household waste.

The next step that may be taken by the Commonwealth will be to mandate all large employers in the state (including all Hospitals, public and private schools, Gov. buildings and colleges) to recycle a certain percentage of their waste stream. Staying one step ahead will benefit C.C.H. in the near and distant future.

What we have started here at CAPE COD HOSPITAL can and should assist our other entities in our Healthcare system. The recognition that we are receiving for our recycling efforts will give us a step up in all aspects of the Healthcare industry as we strive to become leaders and set the example for others to follow.
****

Scott A. George
Recycling Coordinator
Cape Cod Healthcare Inc.

S A M P L E

To: New Employees
From: Recycling Coordinator
Re: Recycling at XYZ Medical Facility

In February of 1995 a Recycling Committee was formed at XYZ Medical Facility. The committee's mission is to identify obstacles, and to overcome them as they related to recycling and energy conservation.

Ongoing Recycling Programs :
1) Mixed Paper; 2) Cardboard; 3) Chemicals; 4) Hospital Equipment;
5) Energy Conservation; 6) X-ray Film

Energy Conservation - We spent over 1,000,000.00 dollars in 1996 on electricity and with your help we want to reduce that amount by at least 5 % - $50,000.00.

Conserve Electricity !
==========Recycling begins with separating and sorting of our trash. If the trash that you are disposing of is not regulated medical waste then chances are "it can be recycled."

$$$$ T H E F A C T S $$$$

Regulated

Medical Waste - Wet / Saturated with body fluids ~~~~~~~~~~~~ Red Bags Only !

General Waste - All Non-regulated waste ~~~~~~~~~~~~~~~~ Clear Bags Only !
* *

Disposal cost of waste - Medical Waste ..... $ 500.00 per ton.
General Waste ..... $ 50.00 per ton.

By thinking before we throw our trash in the wrong container we can save thousands of dollars in waste disposal expenses and at the same time increase our recycling inventory.

The Recycling Committee is asking that all employees, present and new, co-operate in anyway they can to make the recycling of ongoing and future recycling programs a success. Please check bulletin boards and e-mail for up-dates.

********** LET'S USE OUR RESOURCES TO THE FULLEST **********

Scott A. George
Recycling Coordinator
Cape Cod Healthcare Inc.

Sample

Most of what we do and how we save money with our Recycling programs is based on TEAMWORK ! Each program needs the cooperation of key personnel in order to succeed and progress.

Key players in "Hospital Recycling" programs:

Paper Recycling
1) Environmental Services
2) All employees
3) Staff Educator
4) Recycling Vendor (Bins and Boxes)
5) Materials Management

Cardboard Recycling
1) Central Distribution
2) Food Services
3) Warehouse / Stock rooms
4) Dock Management
5) Environmental Services

Xylene Recycling
1) Lab management
2) Lab personnel
3) Purchasing

Bio-hazardous Waste Reduction
1) Infection Control Nurse
2) Staff Education
3) O.R. Staff
4) Environmental Services

In all cases when starting a Recycling program it is suggested that a limited pilot program be put in place before a full scale project starts. This will give you a chance to work out the problem areas.

It is also very important that you have an employee in place that can maintain and monitor programs that are in place.

Other key personnel:
1) Local Fire Department
2) Environmental Protection Agency
3) Fire and Safety Manager

Notes:

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Recycling Coordinator
Cape Cod Healthcare Inc.

SAMPLE

Subject: Recycling of waste materials

Purpose: To recycle waste materials for the purpose of lowering the environmental impact and reducing financial burdens.

Policy Statement: To preserve our environment and use our resources to the fullest, Recycling will be part of our daily processing.

Procedure:

A. The recycling of paper is done hospital-wide.
   1. Brown bins will be placed in all departments.
      a. A list of acceptable paper for recycling will be attached to each bin.
      b. Small collecting boxes will be used to collect paper at the desk.
      c. Boxes are emptied into the recycling bin by the desk occupant.

   2. When the bin becomes full, assigned department personnel will call Support Services, ext. 2496 or ext. 2468.
      a. Support Services will then bring the full bin to a central location and return with an empty bin to the same location.

   3. It will be each department's responsibility to notify Support Services if extra bins are needed for purging of files and/or records - X2468.

B. Cardboard boxes will be transported to the loading dock and placed in the baler for recycling. Transporting of cardboard boxes to the loading dock will be done by Support Services or by individual depts. as previously arranged.

C. Fluorescent Lighting - all spent bulbs will be returned to their original packaging or placed in holding container designed for the transporting of recyclable bulbs. Holding containers and spent bulbs returned to their original packaging will be kept in a separate clearly marked room for recycling.

D. Future recycling items will be added to this policy.

APPROVAL:

_____
Director, Environmental Services

_____
VP- Clinical & Support Services

_____
Recycling Committee Chairman

Scott A. George
Recycling Coordinator
Cape Cod Healthcare Inc.

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Facility-Wide Approach to Reducing Toxics Use

This session explores the methods available to reduce toxics in a health care setting from a facility wide perspective. A holistic approach to managing these resources is necessary in light of changes in the industry, regulation, cost, liability and general demand from the public and others to "do things right". The connection between those who provide health care and those who care about the environment has never been stronger. A shift has occurred from the command and control approach to regulatory management that was prevalent in the 1980's. We now live and work in an environment which demands quality care at a lower cost, and still maintains compliance.

Health care facilities are now able to utilize information garnered from other industries that have for years been required to comply with environmental and health and safety regulations. A misperception that hospitals are "above" compliance still exists in some parts of the country even as the media reports that some aspects of healthcare, such as the disposal of medical waste, have a huge potential to pollute the environment.

Matching the unique nature of a health care facility to compliance with regulations --originally written for industries that created "things" instead of providing medical care to people -- has been challenging. The increasing complexity of the field, which has grown from just managing trash now includes quality improvement and assurance, as well as "beginning-of-the pipe" (demand-side) management concerns. Practitioners are now also involved in abatement of heavy metals and asbestos, water and energy conservation, and health and safety programs. They may all now fall under the general responsibilities of the environmental manager.

Definitions

For purposes of general discussion, the term "toxics" includes chemical (such as hazardous materials) and biological (such as pathological waste) materials. Toxics reduction includes, but is not limited to waste minimization, life cycle costing and resource conservation. The confusion over terminology indicates that much more consistency needs to occur before many of these approaches to toxics reduction can be effectively implemented. Clarifying the words used to describe activities is often the first step in making changes occur, since all parties need to be clear on what exactly is being changed.

Identifying priorities is as important as defining terms. The "big picture" can be viewed with clarity, purpose and vision when priorities are clear. Written documents such as environmental principles or mission statements are important methods to formalize reduction efforts, as well as

to provide a baseline for performance expectations. This type of approach can provide philosophical guidance and to create an internal audit and compliance function.

Understanding the goals that drive internal decision making is crucial when working with limited resources and time. Recognizing the unique nature of the health care industry and internal and external drivers is important. Establishing selection criteria can assist in the establishment of priorities; such as cost, operations, confidence, compliance, quality, environmental stewardship, and regulatory compliance.

The Whole Facility Approach

There are two approaches to toxics reduction. The first includes an overall assessment, or a quantitative audit to establish a benchmark. This approach is usually generated by regulators, insurers, or in mitigation of a negative outcome such as an accident. Facilities that begin the process of toxics reduction by spending large sums of money, time and energy are rare in this economic climate. However, this approach has validity as regulators are examining more holistic approaches to managing environmental resources. This approach is being seen in the Joint Commission 1998 "Environment of Care" standards, which are performance driven and quite comprehensive. These large scale approaches are not easily accessible to those unfamiliar with pollution prevention on a facility wide basis or can be cost prohibitive to many. Facility wide issues include: establishing goals and objectives, developing selection criteria and support, and incorporating appropriate technology.

1. Goals and Objectives

The process of writing and incorporating statements which aspire to or define expected performance can be beneficial in changing behavior. In toxics reduction, this process requires both full administrative support -- willingness to "walk the talk"-- if a principles statement is going to be used for more than a dust collection device.

The enclosed statement required almost a year and eight draft versions to gain full administrative support. Much of it seems at first glance obvious and appropriate. Working against its approval was the perceived cost -- without administrative controls-- associated with adoption. It is an ideal time to educate and introduce the concept that conservation-- be it of resources, time or energy-- SAVES money. Administrators and environmental managers have the same concerns. This recognition of shared commitment assisted in the passage of this specific statement.

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A disconnect can occur at the point which environmental managers need to justify initial investment and return. Traditional training tells us that we need to do "x" project because 1) regulators mandated it, or 2) it is a good idea. Both of these statements are derived from a command and control approach to environmental management, which is outdated and no longer effective. Project "x" may get done, but only to a certain extent. A more pragmatic approach may be very useful: using cost and benefit analysis accomplishes two things: first, it speaks a familiar language to administrators, and secondly, it works from an "opportunity" standpoint.

The enclosed example of an environmental principles statement initially had one primary goal: to unite three individual facilities (a hospital, clinic and medical school) in operating in a consistent manner as it related to environmental management. From this process rose an "Environmental Resources Committee", representing the three facilities and providing oversight, guidance, and feedback to all toxics reduction activities in the facility.

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STATEMENT OF ENVIRONMENTAL PRINCIPLES
DARTMOUTH HITCHCOCK MEDICAL CENTER
1998

In an effort to promote healthier communities both locally and globally, Dartmouth-Hitchcock Medical Center (DHMC) is committed to improving environmental management throughout the organization. DHMC will manage its operations in a manner demonstratively protective of environmental and human health.

DHMC will constantly seek new and better ways to meet its environmental goals through conservation, reduction, reuse and recycling programs, and through partnering with others in the community to safeguard the environment.

These principles will provide DHMC with criteria by which to balance these environmental objectives with other institutional and financial considerations.

In an effort to respect and protect the earth's resources, and to minimize environmental damage, DHMC will:

- Manage, minimize and eliminate, whenever possible, the use of hazardous materials.
- Use renewable natural resources and conserve non-renewable natural resources through cost efficient use and careful planning.
- Use pollution prevention initiatives to reduce negative environmental impacts.
- Minimize the generation of waste through source reduction, re-use and recycling programs.
- Conserve energy and improve the energy efficiency of our operations and make every effort to use and promote environmentally safe, cost-effective and sustainable energy sources.
- Ensure the health and safety of our employees by promoting safe work practices, reducing exposure, using safe technologies, and implementing effective emergency preparedness programs.
- Provide employees with safety and environmental information through training and education programs in order for them to make work/practice decisions in support of these principles.
- Monitor and evaluate our practices as they relate to these environmental principles.

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2. Developing Selection Criteria in Decision Making

Identifying the factors which will consciously drive a decision making process is critical in making it effective. Weighing, or "screening" of these priorities helps keep the decision making process on track and prevent an immediate sense of being overwhelmed, especially as toxics reduction efforts are first initiated. Working in a group process, it is helpful to examine what issues are most important in any specific approach. Has a facility been told to cut 10% from its operating budget? Has a new regulation been promulgated which significantly impacts perations, such as a new industrial discharge permit? Are new methods now available to process instrumentation with less exposure to employees?

One example of a project examined methods to reduce and manage infectious waste using an alternative technology. Personnel involved in the decision making process were asked to examine and state their motivations and concerns. Cost as the driving decision-maker isn't always the sole priority once all the issues are on the table. In one example, the need to be independent in handling one's own system became a surprising, illuminating and refreshing criteria This independence drove a decision to purchase autoclaves to manage infectious waste, and ultimately became a source of pride. This pride also sparked a renewed ownership and commitment to reducing waste in general, which translated into directly quantifiable waste and cost reductions.

3. Incorporating Alternative Approaches in Pollution Prevention

The saying "you can't see the forest for the trees" is very relevant when discussing toxics reduction opportunities. A narrow focus can eliminate the ability to see the whole problem. An incinerator shutdown put a facility into a tailspin as they tried to put an immediate fix into place to address the unexpected cost of shipping waste off-site for processing. The facility managers examined incinerators and other machines that would treat their waste. Much focus was placed on visits to other facilities, looking outward to solve the problem. The focus on the immediate issue missed the real problem: the facility was generating waste at four times the regional average. By examining their definitions as well as waste stream, they cut their costs by 75% before they had to commit to another disposal technology, system or vendor. There is much discussion and attention to "alternative technology", but perhaps "alternative approach" is a more descriptive term as it includes change in process as an option. Leaving options open for future opportunity is helpful. Once the volume of waste was reduced significantly in this example, then the remaining amount could be handled by a technology that was size-appropriate. The facility almost purchased a technology sized to accommodate four times the capacity than was necessary at a much higher cost.

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Specific Opportunities in Toxics Reduction

Perhaps the more common and accessible approach to those new to toxics reduction involves the appreciation for the whole, while seeking opportunities in specific areas and slowly learning and building from both failures and successes. Specific projects can provide an opportunity to understand the intricate framework from which a facility operates financially and politically as well as incorporating the recognized (and less recognized) individuals who make change happen in their areas of responsibility and/or expertise.

1. Infectious Waste Minimization

Perhaps more than any other opportunity to directly impact cost, safety and environmental impact is to reduce infectious waste because of its significant potential to harm people, as well as cause concern to those outside the health care industry. The facility wide approaches listed above can be utilized in accomplishing this goal. Another motivation to reduce infectious waste is the benefits to the relationship to the community.

In introducing reduction efforts, education, containers and employee compliance are easy targets for change. What often happens is that the problem lies in how materials are handled, especially in labor allocation. The problem quickly can become more complex, requiring additional review of the organizational system of handling materials and waste. The interconnections between handling and disposal become more and more important. Several excellent references already exist to assist in reducing infectious waste. They include ”An Ounce of Prevention: Waste Reduction Strategies for Health Care Facilities” by the American Society for Health Care Environmental Services (1993) and “Environmental Management in Health Care Facilities” by Kathryn D. Wagner (1998).

2. Proactive Approaches in Environmental Management

Another toxics reduction opportunity lies in product substitution. Ethylene oxide is an extremely hazardous material commonly used as a gas sterilant in health care facilities. Problems include maintaining inventory, handling the gas, environmental monitoring, and projecting the costs of future control technology. These concerns caused one hospital to explore replacing ethylene oxide with alternative technologies, work practices, and introduction of compatible instrumentation. It required committing to phasing out the use of this sterilant in a federal permit application in order to maintain existing environmental compliance.

The cost of air, personnel and leak monitoring would be avoided by this change. Product substitution would allow for less down time for training and emergency drills. It would free employees from the fear of leaks or off-calibration false alarms. But it would also

require extensive cooperation with clinical staff to understand, appreciate and resolve their issues regarding a significant change in protocol, FDA and internal infection control approvals of alternative technologies and change in handling reusable instrumentation.

The substitution is almost complete for this facility and represents the first of its kind in its region.

3. Life Cycle Cost

Identifying the real cost to a facility of the entire life cycle of a product can be very effective in specific areas which represent opportunities for toxics reduction. Mercury is an excellent example. The purchase cost of a mercury thermometer is very low. The safest disposal for elemental mercury is triple distillation recycling, which is very expensive and requires that thermometers be collected, transported and delivered intact to a hazardous materials recycling facility and processed. It requires tracking of paperwork and other regulatory requirements on an ongoing basis. This can triple the whole life cycle cost: from the point to sale to ultimate disposal. Educating purchasers and users is critical in reducing toxics such as mercury from the health care setting, and should go together with discussions regarding mercury toxicity that many communities are now having. Identifying all devices which contain mercury compounds can be an excellent specific toxics reduction opportunity, as almost all compounds have a less expensive alternative on a life-cycle cost comparison. These devices are used in many locations and can be an excellent first step in a facility wide program to identify and reduce toxics in a health care setting.

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Jonathan Goldberg, MHSA
Massachusetts Hospital School
Department of Public Health

Environmental Stewardship:
Meeting our environmental responsibility & regulatory requirements through JCAHO Environment of Care management plans

The Massachusetts Hospital School – an overview

The Massachusetts Hospital School is a Department of Public Health, JCAHO accredited pediatric rehabilitation hospital. We serve as both a hospital and a school for physically handicapped children. It is part of our mission to demonstrate leadership and to manage our facilities with programs that reduce potential exposures and risks to our patients, students, employees, and the community.

The campus includes 24 structures with a combined total of 480,000 square feet of floor space including school buildings, administration buildings, gymnasium/pool, hospital and residential buildings located on Old Reservoir pond - with 161 acres of land.

Buildings have been constructed over a period of 80 years. All are supplied with heat and electrical power distribution from a boiler plant commissioned in 1982.

The school portion of the program follows a fairly standard school year schedule (with summer program usage 6 - 7 weeks each summer). The hospital has 110 beds and operates 24 hours each day throughout the year. Administrative buildings are open weekdays during normal business hours.

Boston Edison through 13.8 kV feeders provides electrical service. The majority of the electrical distribution throughout the campus is supplied through 4160 Volt lines from the new boiler plant - electrical distribution panels.

There are two standby diesel generators in the power plant. One is rated for 400 kW at 4160 Volts supplying several 4160 Volts feeders and a smaller unit rated for 180 kW at 480 Volts supplying four buildings and the Plant itself. There are two additional back up generators on campus - a 27 kW diesel located in the hospital building, and a 30 kW natural gas generator located in one of the school buildings.

Space heating and domestic hot water heating requirements are met using steam supplied by 2 Cleaver Brooks watertube boilers (rated for 20,000 lbs./hour at 150 psig). Domestic hot water is produced locally using steam coils in hot water storage tanks. Another boiler, a smaller Kawanee fire tube boiler (rated for 10,000 lbs./hour at 150 psig) is used during low load seasons.

Air conditioning loads are met by a combination of electrical Direct Expansion systems, an absorption chiller (190 tons), and a natural gas energized chiller.

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To improve the facility's energy resources, a 252 kWh turbine generator has been installed (1/95). Design parameters would allow this generator to operate with reduced loads down to 47 kWh. Piping and PRV modifications were made to convert the high-pressure distribution steam network - to a low-pressure network (except for a high-pressure sterilizer line).

JCAHO – Environment of Care Standards

The JCAHO accreditation process has provided us with the opportunity, through the Environment of Care Standards, to establish and build the framework of environmental stewardship management plans into our organizational life. The intent of the Environment of Care Standards (EC) is defined in the JCAHO – CAMH Refreshed Core, January 1998 manual as:

Effective management of the environment of care includes using processes and activities to: *reduce and control environmental hazards and risks; prevent accidents and injuries; and maintain safe conditions for patients, visitors and staff .*

We have, over the past 6 years, built into our EC management plans, environmentally responsible processes. We have expanded the traditional interpretation of the intent to include pollution prevention, resource conservation and innovation in environmentally gentle technologies and practices, as vital and linked aspects of our plans, daily operations and organizational values.

The EC management plans, developed and formalized through the facility Safety Committee, become accreditation driven management objectives. The plans receive facility validation and support through the Hospital's performance improvement processes, strategic planning and the budget (capital & operational).

Performance Improvement & environmental stewardship

Our facility uses the performance improvement model of:

- Plan
- Do
- Check
- Act

As with other organization priorities and initiatives, environmental opportunities to improve are developed using this model.

Plan
- Gathering data at the beginning of the design phase
- Research what are our present practices & best practices in our and other industries
- Involve local authorities having jurisdiction (Fire Departments, Public Safety inspectors, Conservation Committees, etc.)

Do
- Hire a Licensed Site Professional to complete an environmental audit
- Review environmental audit and implement plans to conform with or exceed regulatory requirements
- Understand impacts – beyond regulatory issues – develop plans that incorporate environmentally responsible facility management
- Develop plans to fix regulatory issues – link with Strategic Plans & Capital budgets

Check & Act
- Implement & evaluate plans that fix/define/improve impact on non-regulatory issues
- Report findings to Performance Improvement
- Obtain certificate of compliance's, certificates of inspection or permits to operate – as required

Beyond the intent of the EC Standards, several of the standards – requiring management plans, provide opportunities to incorporate environmentally responsible initiatives.

Sustainable design and specifications

EC 1.2
When designing the environment of care, the organization uses design criteria referenced by the health care community.

References used by health care organizations must include not just regulatory and code related sources – but references that focus on the environmentally important aspects of health care's environmental responsibility. The planning phase of implementing EC management plans, with environmentally responsible inclusions, is the time to incorporate opportunities for future improvements. Linking capital construction and budgets and strategic planning at this phase is essential.

Some steps to take when planning renovations or new construction could include:

- Design space for recycling containers, compactors, balers, loading docks, separate closets

- Incorporate occupancy sensors – for lighting, heating & cooling systems
- Exterior lighting that is efficient, but also controllable and designed with insect reduction or redirection in mind
- Staff shower facilities and bicycle racks
- Maintenance of existing habitat for birds
- Landscaping that is drought tolerant, native, compatible
- Alternative energy sources

Simple environmentally responsible design ideas can be included in renovations or new construction. Specifications requiring that engineers or architects – have experience in designing environmentally responsible buildings should be included in the bidding process for hiring engineers or architects. The Commonwealth of Massachusetts – Operational Services Division web page – http://www.osd.com has a copy, on line of specifications that can be included in any bidding document. These sustainable design criteria, including life cycle analysis in the design phase, are ways to integrate the procurement function of hospital operations into environmentally gentle management.

Use the standard of exceeding code requirements for energy aspects of renovations/construction as a baseline. Opportunities for utility sponsored rebates and partnering with companies looking for pilot locations for innovative technologies are cost saving opportunities that can help offset capital costs.

This is also the time to broadly interpret a project as a piece of work linked to past construction/renovations, present operations and future construction and operations. We define our capital improvements as phases of work. An example is to incorporate valves, piping or control points in a present design - to be used in the future to allow for the easy connection as a potential back up for an aging one. Another example is the inclusion of standpipes, valves and piping into buildings, during a water line improvement project – for future use for sprinkler installation.

Procurement as a partner in environmental stewardship

Another step is to incorporate as many environmentally responsible requirements in all procurement specifications. The JCAHO standard, which formally recognizes the importance of purchasing on the Environment of Care, is:

EC 1.7 A management plan addresses life safety
c. Reviewing proposed acquisitions bedding, window draperies, and other curtains, furnishings, decorations, wastebaskets, and other equipment for fire safety .

Steps to take include:

- toxic reductions – reduce quantity
- recycling (cradle to new cradle approach – part of the loop)
- mandate that specifications for any hazardous waste contractor – include unannounced site visits to their plants and that – inspection of transport vehicles provided by contractors – will also be inspected
- build in information collection from vendors, into contract – build in training
- Automotive fuel – transportation alternatives
- Solid waste management
- Recycling
- Buying recycled
- Waste stream management
    - Office paper
    - Corrugated
    - Steel & aluminum cans
    - Glass – all colors
    - Plastics (various types)
    - Co-mingled design
    - Phonebooks
    - Construction debris
    - Construction salvage
    - Surplus property process
    - Re-use packaging material

Pollution prevention – hazardous materials

A standard that clearly speaks to environmental responsibility is:

EC 1.5 A management plan addresses control of hazardous materials and waste. selecting, handling, storing, using and disposing of hazardous materials and waster from receipt of generation through use or final disposal .

Steps to take and areas to integrate into this standard (in an outline form) include:

- Update existing contracts and facility operations to change from a pest extermination contract to an Integrated Pest Management program. There are cost saving opportunities and environmental impacts involved. A great reference for IPM is available on the World Wide Web at the Commonwealth of Massachusetts Department of Food and Agriculture – Pesticide Bureau web page (www.massdfa.org) – IPM Kit for Building Managers.

- Toxic reduction
  - Change process or equipment to reduce waste generated Increase efficiency of existing process or associated equipment to reduce usage of toxic material
  - Use a different material to do the same process – to minimize impact of toxin
  - Use "Green" Housekeeping chemicals

- Great references include:
  - Guidelines for Green Building Housekeeping and Maintenance - Rochester Midland Corporation, 1995
  - Environmentally Preferable Cleaners - Product Health & Environmental Specifications and Checklist
  - Request for Proposal - Environmentally Preferable Cleaners - RFR # GR004 Commonwealth of Massachusetts
  - Operational Services Division – World Wide Web Page - http://www.osd.com/enviro/enviro.htm

- Develop Spill Containment & Countermeasure Plans – even if not required to do so by regulation
- Water quality and conservation
  - Waste water monitoring, flow & metering
  - Install pool covers – especially in heated in-building pools
- Indoor air quality
- Yard/landscape waste & composting
- Purchasing items without PVC contents (if available)
- Energy management
- Electrical efficiency

Outcomes

The Massachusetts Hospital School has realized positive economic, regulatory, public relations, and environmental benefits directly related to the pollution prevention initiatives we have instituted. We have received Federal Environmental Protection Agency and Commonwealth of Massachusetts recognition for these efforts. These pollution prevention initiatives are easily duplicable by other health care organizations.

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Practical P2 Applications in the Hospital: Children's Hospital of Wisconsin Case Study

In the 1980's, there was widespread concern about medical waste due to media reports of syringes found on public beaches. Although Wisconsin chose to not participate in the federal medical waste program, it had concerns of its own. Public opposition to new commercial incinerators was high. A 1991 study revealed that the state had capacity to treat more infectious waste than it generated and that many of Wisconsin's 150 medical waste incinerators were legally burning recyclable waste along with their infectious waste under an exemption in the state's recycling law. Outside the healthcare sector, sharps injuries were increasingly common among waste handlers, and recyclable materials were being sent to landfills due to the actual or suspected presence of sharps.

To address the environmental and safety concerns, the state legislature established a moratorium on new regional medical waste incinerators and asked the Department of Natural Resources (DNR) to write rules for managing and reducing medical wastes. DNR invited healthcare providers, environmental groups, waste haulers and others to help write the rules, which were adopted in 1994. These rules required hospitals, clinics and nursing homes ("medical facilities") to write and implement plans to reduce the amount of medical waste being generated. Rather than mandate percentages of reduction, the rules require each medical facility to audit its waste, develop and implement its own plan, set its own goals and choose how to meet the goals within its own context. The plans must include elements common to successful waste reduction programs of all kinds. For example, each facility must commit to the waste reduction hierarchy, examine potential cost savings, consider impacts on patients, improve waste handling practices (e.g., source separation), evaluate purchasing practices (such as alternatives to the use of disposable items), train employees annually, and consider internal incentives.

In 1994, Children's Hospital of Wisconsin embarked upon an ambitious program to reduce wastes and prevent pollution throughout their facility. Using their safety committee as the initiator, hospital top management was garnered. With the assistance of the University of Wisconsin-Extension's Solid and Hazardous Waste Education Center, a waste audit of the facility was conducted, which identified opportunities for pollution prevention, especially in the usage of toxic chemicals, including mercury. Each area of the facility was targeted with a specific pollution prevention strategy, with operational managers charged with implementation. The following are key findings of this effort:

- Essential components for a successful pollution prevention program must be in place, including top management support, team history of successful work, knowledgeable and committed staff, and a materials management policy, including risk assessment;

- Targeting "low hanging fruit" (e.g., thermometers) leads to early success, allowing for more difficult follow on challenges;
- Low risk mercury containing items can be phased out over time;
- Solvent recovery is easy to implement and very cost effective; and
- Alternative, non-mercury containing products are often cheaper and as effective.

Implementation of a pollution prevention program has reduced risk and improved profitability at Children's Hospital. Additional initiatives that have resulted from the Children's Hospital pollution prevention program include the:

- Development of a "trigger" screening database that will link purchasing decisions with material data sheets and other toxics databases to screen for less toxic products;
- On-going mandatory staff training; and
- Recognition as a Governor's Waste Minimization award winner.

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Process Inefficiency Breeds Medical Waste

The healthcare industry is rife with potentially dangerous toxins. Radioactive, chemical, biological, and pharmaceutical waste products pose a danger inside and outside healthcare facilities. Air quality issues have forced some hospitals to redesign HVAC systems, and even ban latex balloons. Routine procedures require masks and gloves to eliminate the risk of blood and fluid borne infections. Nosocomial infections – those acquired during care – are a constant concern.

Many of these risks are endemic in healthcare and the chemicals, drugs, and equipment used to treat patients. Many are endemic in the treatment of patients suffering from infectious diseases. Proper precautions and processes can reduce the level of risk and manage what risks remain.

Total quality management plays a role in reducing the toxic waste problem in healthcare, as it does in other industries. Wasteful and inefficient processes that use toxic products increase toxic waste. The key to eliminating waste, inefficiency, and rework in processes is total quality management.

Pharmacy processes are an example of the effect quality management tools and techniques can have on toxic waste. Many drugs are dangerous toxins. Processing drugs often requires laminar flow air hoods that vent directly to the outside. Disposing of many drugs, and their accompanying syringes and needles, is a biohazard issue. Quality management tools and techniques have addressed several drug delivery system issues that increase toxic waste:

- When a patient transfers from one nursing unit to another the pharmacy system was not updated in a timely manner. The patients' drugs were delivered to their old unit – and consequently returned – while the new unit was ordering additional drugs. The effect was wasted drugs.
- Physicians' orders were not communicated to the pharmacy in time and (now) unnecessary medications were produced and delivered, then returned. More wasted drugs.
- Most drugs have short shelf lives. Poor production and inventory control practices that produce an overstock increase the amount of medications expiring unused.
- Poor quality in the medication manufacturing process leads to waste and rework.

A series of quality management projects addressed these issues and created a new order entry system and a new pharmacy delivery system. The end result was improved process efficiency and reduced toxic wastes.

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Quality management tools have addressed similar issues in other waste generating processes: radiology, operating rooms, central processing departments (which sterilize instruments and equipment using toxic gases), and clinics.
Conversely, control charts are increasingly used to address nosocomial infections – infections acquired during treatment. Control charts identify when a statistically significant event – or events – have occurred. This triggers an investigation and improvement effort. Control charts tell when and where an infection outbreak has occurred, focusing the organization's resources on ending the outbreak and preventing future outbreaks. Since nosocomial infections are often the result of poor processes, or poor compliance with process guidelines, infection control efforts often become process improvement efforts and use quality management tools and techniques.

Quality management provides powerful process improvement tools and techniques. When used on processes with toxic outputs these tools become powerful toxic waste reduction tools. The use of quality management tools has a proven track record in healthcare of improving cost and quality. They have also reduced the potential toxic waste output of these lifesaving services.

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Barriers to Reducing Mercury Pollution From Dental Offices in King County, Washington

Since 1991, the King County Local Hazardous Waste Management Program (LHWMP) has actively worked with dentists to reduce mercury pollution through technical assistance and outreach programs. This paper describes methods used to investigate the introduction of pollution prevention techniques and details barriers that must be overcome for dentists to begin reclaiming mercury-bearing wastes.

Introduction and Background

Historically, mercury has appeared as a problem in Pacific Northwest wastewater treatment systems. The imminent listing of one or more salmon species as endangered again focuses attention on Northwest water quality issues.

Previous studies in the region indicate that dentists in King County are responsible for 14 percent of the total mercury entering the sewer system (more than from any other business sector. This amounts to 51 pounds of mercury per year entering the local sewer system as amalgam particles and is about a quarter of all amalgam waste generated by dentists. A 1997 audit of dental offices indicated that only 20 percent reclaim some of their amalgam waste (usually dry scrap) while less than a dozen offices have installed wastewater treatment units.

Reducing pollution from mercury-bearing amalgam wastes requires a change in operations and often the introduction of new technology. Dental offices must collect these wastes and send them to a mercury reclamation facility. Collection must occur at a number of points: dry (non-contact) scrap amalgam, chairside trap solids, pump filter solids and particles in the wastewater. Above all, collection and reclamation of these amalgam wastes involve a change in behavior.

Behavior Change

A growing body of literature on behavior change suggests that technology alone is not sufficient to change behavior. Rather, behavior change requires a systematic approach to understanding the audience and its barriers to adopting a new technology or system to prevent pollution. If barriers to change are accurately identified, program strategies can more effectively persuade the audience to adopt the new technology or system.

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Methodologies Used to Identify Barriers

In King County, a combination of methods were used over a number of years to learn how the dental community deals with waste management issues as well as the barriers to introducing pollution prevention practices.
Methods include:

- Waste samples from chairside traps, pump filters and operatory wastewater were analyzed to quantify the extent of mercury contribution from dental offices.
- Written surveys provided self-reports on waste disposal, attitudes toward reclamation, preferred information sources, and perceived needs.
- Field data from visits to dental offices documented waste disposal practices, attitudes and knowledge levels of dentists through direct observation.
- Key informant interviews with selected dentists provided in depth data about waste disposal decision-making, credible information sources, attitudes toward the government and views on marketing. Interviews with vendors provided insights into technological developments and the market situation for reclaiming dental amalgam waste. Interactions with the county and state dental associations and with the University of Washington Dental School supplemented this information.
- Literature reviews encompassed publications about similar programs elsewhere; local, state and national dental journals; research studies on the adoption of innovations by dentists; and studies on health and safety effects of amalgam and mercury.

Barriers to Reclamation of Mercury by Dentists

We found that dentists' barriers to amalgam reclamation fell into three areas – technical barriers, organizational resistance and personal barriers.

Technical barriers include logistical problems and those aspects of the external environment that impede a desired change. In the case of amalgam reclamation by dentists in King County, these are:

- Lack of reclamation options. Few (one or two) haulers are available to pick up amalgam wastes from dentists in King County. Lack of a viable market means costs are higher. Mail-in services or drop-off programs are the only other options.
- Dental offices are not standardized, and a wastewater treatment unit may or may not fit into a particular office. Most available treatment units do not technically meet county discharge levels for mercury.

Organizational barriers are those aspects of the social structure that stand in the way of desired change. They include:

- Dentists are highly organized within a hierarchical structure in which the national agenda influences local dentists. In this case, the national association resists identifying amalgam as an environmental or health hazard and opposes government involvement in internal operations.
- Dentists are difficult to contact directly. Information is filtered through professional associations, suppliers, schools and office employees.
- The region's leading dental school has no coordinated unit on waste management. Information is scattered throughout the syllabus.

Personal barriers include aspects of the individual, such as attitudes and level of knowledge, that stand in the way of change. In the area of amalgam reclamation, these include:

- Knowledge about the importance of amalgam reclamation is low. Most dentists consider it infectious waste and dispose of it in the 'red bag' (which is ultimately burned).
- Cost of pollution prevention equipment and reclamation services is a new cost for most dental practices.
- Dentists distrust the government as a source of information. They dispute the environmental impacts of mercury-bearing amalgam.
- Dentists don't link their own practice with environmental issues.
- Time can be a barrier; dentists are busy and don't consider waste management a priority.

With an understanding of these barriers, the King County LHWMP program is now developing and implementing strategies to introduce pollution prevention to dentists.

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Health Care Mercury Elimination and Reduction Memorandum of Understanding (MOU)

Pollution Probe is a non-profit environmental organization located in Canada. Over the past three years, as part of the Mercury Elimination and Reduction Challenge (MERC) project, Pollution Probe has worked in partnership with many stakeholders on mercury pollution prevention issues. One of the major focuses of this project has been the reduction of mercury in the health care sector.

In April 1996, a *Mercury Pollution Prevention in the Health Care Sector Workshop* was held which examined the effects of mercury on human health, presented examples of mercury pollution prevention case studies in the health care sector, and reviewed some alternatives to mercury containing products and devices. The ***Health Care Mercury Elimination and Reduction Memorandum of Understanding (MOU)***, a voluntary pollution prevention agreement for Ontario, was signed at this workshop. Signatories of the MOU included: Centenary Health Centre; the Hospital for Sick Children; The Toronto Hospital; Environment Canada; the Ontario Ministry of the Environment; the Health Care Environment Network (HCEN); and Pollution Probe.

Each of the current hospital signatories has developed their own strategy and policy for reducing and eliminating mercury. The MOU signatories and other hospitals have formed the Ontario Mercury Health Care Steering Committee. This Steering Committee was formed to encourage information sharing and to promote the elimination and reduction of mercury-containing products in the health care sector. Hospitals in Ontario, together with Pollution Probe, recognized the need to develop cost information on mercury-free products to assist with the process of reducing mercury use. The *Mercury in the Health Care Sector: the Cost of Alternative Products* report compares the costs of some of the hidden training, disposal, administrative, health, and environmental costs associated with the use of mercury containing products.

This project has been expanded to encourage hospitals across Ontario to sign the MOU. Pollution Probe and the Health Care Environment Network (HCEN) organized a session at the Ontario Hospital Association's (OHA) annual conference in November, 1997. The Health Care MOU was highlighted as a specific, achievable pollution prevention initiative currently being undertaken by Ontario hospitals. Pollution Probe is also planning to expand the MOU to Atlantic Canada.

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Bruce Lourie *has a geology degree and a Master's degree in environmental studies. Mr. Lourie has worked with Price Waterhouse where he was involved in health services and technology projects, and is the principal in the firm Lourie & Love Environmental Management Consulting. Mr. Lourie has been managing environmental research and policy projects for Pollution Probe over the past seven years and initiated Probe's Mercury Elimination and Reduction Challenge (MERC) project. He can be contacted at Pollution Probe, 1216 Yonge Street, Suite 201, Toronto, Ontario, M4T 1W1. Phone: (416) 922-9038. Fax: (416) 922-1028.*

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Wisconsin's Environmental Cooperation Pilot Program
Breaking Through to Enhanced Environmental Performance

Wisconsin's healthcare providers, waste handlers, environmentalists and state government are pioneers; working together to reduce the generation and incineration of medical waste. Initial collaboration has led to rules that address both the environmental and safety concerns of medical waste. Rather than mandate percentages of reduction, these rules require each medical facility to implement its own plan for medical waste reduction. These plans include elements common to performance based environmental management systems (EMS). For example, each facility must commit to the waste reduction hierarchy; examine potential cost savings; consider impacts on clients; improve waste handling practices; evaluate purchasing practices; train employees annually and consider internal incentives for continuous improvement. Healthcare administrators sign annual reports to DNR to demonstrate top management support of improved environmental performance. The department is now building on the success of our medical waste reduction program, to address other environmental concerns.

When evaluating what areas of improvement could be included in healthcare, a systematic review of healthcare impacts on the environment will be key. The Environmental Cooperation Program is a pilot program designed to evaluate alternative methods to compliance based environmental management. Traditional "command and control" regulatory strategies can be costly leaving the healthcare organization with few alternatives to improve environmental performance. The program builds off an environmental management system based on a continuous quality improvement model to design a facility specific cooperative agreement. Cooperative agreements embody a whole-facility, multi-media approach. In addition, the program expects a strong stakeholder element to successfully negotiate an agreement. Agreements will be designed to promote the overall reduction in levels of pollution through a more flexible approach. The agreements overlay permits and approvals, and offer latitude to reduce administrative burdens or supersede certain requirements of permits and approvals during the agreement's effective period. The department will spend the next 5 years cultivating up to ten cooperative environmental agreements.

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Wisconsin's Medical Waste Reduction Program

Wisconsin has developed and implemented a comprehensive program for reducing medical wastes involving many public and private entities. The state legislature has adopted policies on incineration, recycling, and medical waste reduction; the state Department of Natural Resources has written and implemented regulations for managing and reducing medical waste; hospitals, clinics and nursing homes have implemented medical waste reduction plans and complied with the state's recycling law; and environmental groups have worked to remove non-regulatory challenges to waste reduction. Together, the groups have made substantial progress in reducing medical waste in Wisconsin.

Background In the 1980's, widespread concern developed about medical waste due to media reports of syringes found on public beaches. While Wisconsin chose not to participate in the federal medical waste program, it had concerns of its own. Public opposition to new commercial incinerators was high. With the support of environmentalists, the state developed new toxic air emission regulations controlling emissions from medical waste incinerators in 1988. At the time, the hospital association opposed these new regulations but was unable to stop their promulgation.

A 1991 study revealed that the state had capacity to treat more infectious waste than it generated and in fact was a net importer of medical waste from around the region. Non-infectious items were often mixed with infectious items leading to a disproportionate amount of waste being handled as infectious and ultimately, for the most part, being incinerated. Because wastes were mixed, many of Wisconsin's medical facilities were burning recyclable waste along with their infectious waste. (In Wisconsin, medical waste is defined as "infectious waste and other waste that contains or may be mixed with infectious waste".)

Wisconsin's program has progressed through several stages: developing policies, writing regulations, implementing the requirements, meeting the challenges of these efforts and continuing to evolve the program.

Policies In the early 1990's, the state legislature established a moratorium on the construction of new medical waste incinerators, adopted a recycling law, and charged the Department of Natural Resources (DNR) to develop rules for managing and reducing medical wastes. The rules were to emphasize the separation of infectious from non-infectious waste and to require medical facilities (hospitals, clinics and nursing homes) to develop ***and implement*** medical waste reduction plans. To our knowledge, no other states require implementation of medical waste reduction plans.

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Regulations The DNR invited healthcare providers, environmental groups, waste haulers and others to help write the rules (NR 526, Wis. Adm. Code), which were adopted in 1994. Wisconsin's medical waste rules define terms, establish requirements for packaging, handling, storing, shipping and transporting medical waste. They establish requirements for medical waste reduction by hospitals, clinics and nursing homes. The rules complement the state's recycling laws by promoting better waste management practices and alternatives to disposables in healthcare.

The rules assume that the volume of legally "infectious" material generated is relatively small compared to the overall waste produced at any one facility. The rules also assume that source separation is the best method and single most important step for reducing the amount of waste that must be treated as infectious. The rules explicitly require all infectious waste generators to separate wastes at the source, including individuals who generate sharps.

The rules assume that self-implementing programs for waste reduction which meet a base level of effort are more efficient and cost-effective that programs which require comprehensive governmental reviews and approvals. However, public access to the plans and simple reporting hold facilities accountable. For example, medical facilities must submit annual progress reports to the state and the rules allow the state to review waste reduction plans and enforce them when necessary. A filing fee associated with the annual reports helps support the state's medical waste regulatory program.

Deadlines for medical facilities to implement their plans were staggered according to the amount of waste generated; those generating more than 500 lb/mo were to have implemented their plans in 1995, those generating 200 to 500 lb/mo in 1996, and those generating 50 to 200 lb/mo in 1997. Staggered deadlines ensured that the largest generators would reduce wastes right away and gave smaller medical facilities incentive to comply with the intent of the rule early so they could delay or eliminate the need for paperwork and fees later.

Medical waste reduction plans Medical facilities generating more than fifty pounds of medical waste a month must write and implement plans to reduce medical waste generated by their facility. Based on prior experience with toxic reduction and waste reduction in hospitals, the rules specify a process that promotes material management rather than an analysis of end-of-life disposal options. Medical facilities are encouraged to improve no matter where they are in the process and to look at ALL wastes, not just medical waste. The rule does not punish those who had already done a lot to reduce waste. Rather than mandate percentages of reduction or statewide numerical goals, the rules require each medical facility to set its own goals and choose how to meet the goals within its own context.

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Simply put, a medical waste reduction plan is a working internal document that describes how the medical facility has managed waste in the past and how it will reduce waste in the future. Every medical waste reduction plan must include the following 7 components, which are common to successful waste reduction programs of all kinds:

(1) Setting specific goals and objectives, including a self-chosen numerical goal for infectious waste generation.
(2) Describing past practices and "baseline" (current) practices.
(3) Improving waste management practices.
(4) Examining alternatives to disposable items.
(5) Educating those who generate waste (employees and the public).
(6) Monitoring progress and submitting progress reports to DNR.
(7) Identifying who is responsible for implementing the plan.

Facility administrators must sign annual reports to DNR to ensure top management support for continuing waste reduction efforts. The plans are publicly accessible, which enables local citizens and environmental groups to encourage medical facilities to reduce waste.

Implementation Medical facilities are now implementing waste reduction plans supported by the University of Wisconsin Extension, the state Department of Natural Resources, environmental groups and other organizations. Substantial changes in the management of medical materials have occurred throughout the state, such as:

- Most medical waste is now being treated by non-incineration methods. Fewer than five medical facilities are still operating incinerators and, at this time, none of Wisconsin's commercial incinerators are operating. This has undoubtedly improved air quality in Wisconsin.

- Less waste needs to be incinerated or specially treated. Reductions in medical waste of 20 to 50% are common in medical facilities across the state and vary depending on previous waste reduction efforts.

- Most medical facilities (unless exempt) have implemented waste reduction plans and begun reporting their progress to the state. As a result, many have saved substantial amounts of money and diverted wastes from landfills.

- Although most reductions in medical waste appear to be due to source separation alone, some is due to material substitution and other waste reduction strategies.

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- More materials from medical facilities are being recycled. Most medical facilities are separating wastes and complying with Wisconsin's recycling law. Those with waste reduction plans are able to reassure potential materials recyclers about the quality and safety of their recyclables.

The partners are now working on resolving non-regulatory challenges to waste reduction.

Challenges Efforts to reduce and recycle medical materials have been hampered by a variety of challenges. With support from the WI Recycling Market Development Board, an environmental organization brought together everyone who handles a product through its life cycle from medical suppliers to processors of recycled materials. This group identified the challenges and some potential solutions to implement successful medical waste reduction policies.

In all, forty-four issues were identified. Both the interviews and the focus group results indicate that a challenge for one part of the chain is often a challenge for another. The focus group prioritized the challenges down to nine.

Nine Priority Issues Identified by the Focus Group (December 1995):

- Finding a separation process, containers, and internal storage space for products.
- Fostering communication among all players - people who produce packaging,
- end-users, etc.
- Committing to recycling in hospitals.
- Creating a system for identifying products and materials.
- Stimulating markets for certain materials.
- Reducing the stigma associated with medical waste.
- Emphasizing quality control in source separation and minimizing contaminants.
- Creating economies of scale through contracts for purchasing and disposal.
- Recognizing that needs of hospitals vary by type of facility and geographic area.

The group focused on these nine challenges, generating solutions that covered the breadth of the material management chain. In March 1996, representatives from medical facilities, state agencies, vendors and environmental groups convened to discuss the challenges and to help each other meet the new state requirements. The publication, *Closing the Loop: How to Reduce, Reuse and Recycle Medical Materials*, printed June 1998, captures the results of this work.

None of the challenges posed an absolute barrier to reducing, reusing or recycling medical materials. Communication and education surfaced as a main challenge both within a medical facility and between the different stages of the material management chain. Solutions have been identified for all the priority challenges. Significantly, the solutions gleaned from the participants in the project, either tried and tested or new ideas,

lie within the medical sector and the medical material chain. Few solutions called for government action or involvement.

Future In order to continue Wisconsin's progress, we are:

- Analyzing the changes that have taken place to determine how successful waste reduction efforts have been and how to improve them.
- Integrating waste reduction planning with facility environmental management systems and Total Quality Management strategies.
- Eliminating the use of mercury in health care.
- Considering additional policies and regulations.

Copies of Ch. NR 526 may be obtained from the DNR or by directing your web browser to http://www.legis.state.wi.us/rsb/code/ Click on "Get Acrobat Reader" to download the software you'll need to read the rules. Click on "Natural Resources," click on "Chs. 500-590," click on "NR 526."

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Getting to Zero

Under the Great Lakes Initiative (GLI), water quality standards designed to minimize the discharge of persistent toxic substances into The Great Lakes Basin, wastewater treatment plants in the Great Lakes basin will soon be required to meet stringent mercury discharge limitations. To meet these limitations, hospitals discharging a Publicly Owned Treatment Works (POTW), may be required to reduce or eliminate their discharge of mercury. The use of mercury containing equipment and the use of mercury containing fixatives are large sources of mercury to wastewater discharge. Once a hospital has replaced its mercury containing equipment, the use of mercury containing fixatives in tissue preparation remains a source of mercury contaminated wastes. Pollution prevention practices, such as the use of mercury free fixatives, and proper management of these wastes can reduce or eliminate this source of mercury discharge. Pollution prevention efforts are more likely to succeed if they include recognition of barriers to change.

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